#1

ASSOCIATION D'OCÉANOGRAPHIE PHYSIQUE

Union Géodésique et Géophysique Internationale

#1

PROCÈS-VERBAUX Nº 1

Cinquième Assemblée Générale
réunie à Lisbonne
Septembre
1933

HELSINGFORS
FRENCKELLSKA TRYCKERI AKTIEBOLAGET
1934

ASSOCIATION D'OCÉANOGRAPHIE PHYSIQUE

Union Géodésique et Géophysique Internationale

PROCÈS-VERBAUX Nº 1

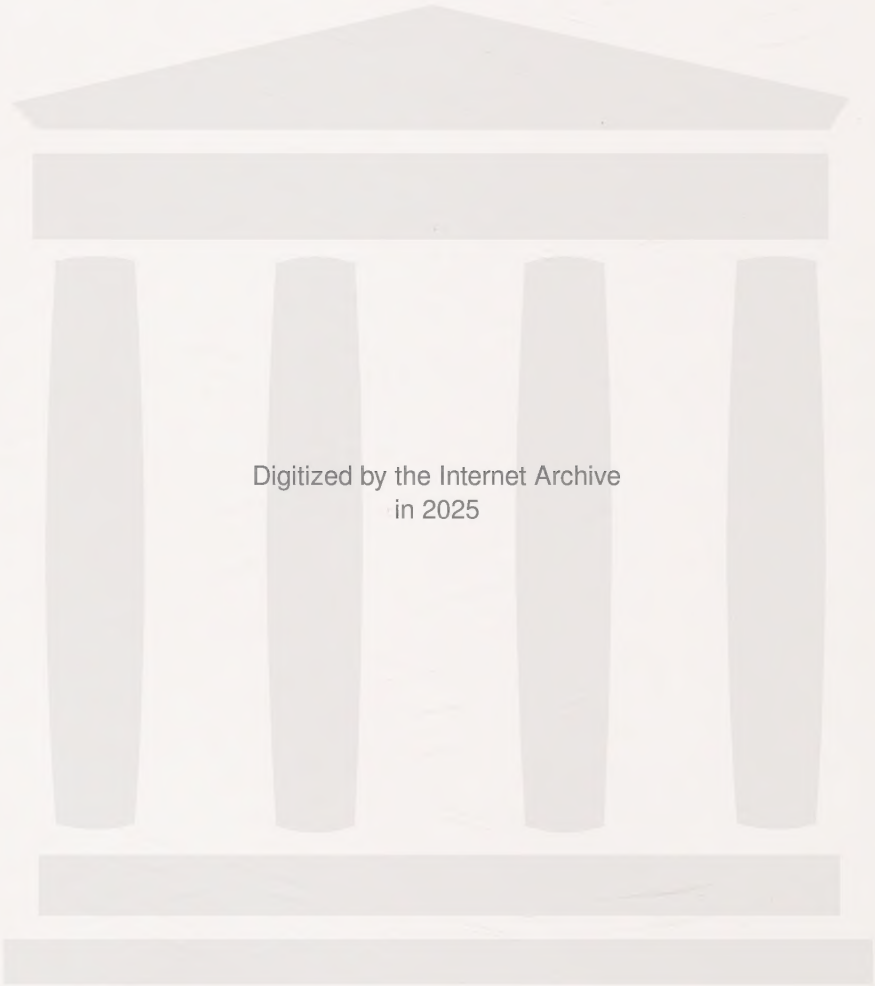
Cinquième Assemblée Générale
réunie à Lisbonne
Septembre
1933

HELSINGFORS
FRENCKELLSKA TRYCKERI AKTIEBOLAGET
1934

DANS CETTE SÉRIE SERONT PUBLIÉS LES ACTES DE CARACTÈRE ADMINISTRATIF CONSTITUANT SUITE À LA PARTIE CORRESPONDANTE DU BULLETIN DE LA SECTION D'OCÉANOGRAPHIE DE L'UNION GÉODÉSIQUE ET GÉOPHYSIQUE INTERNATIONAL.

LES PAMPHLETS DE CARACTÈRE SCIENTIFIQUE FORMENT LA SÉRIE: PUBLICATION SCIENTIFIQUE, DÉJÀ COMMENCÉE.

L'Assemblée Générale
de l'Association d'Océanographie Physique
a eu lieu à l'occasion de l'Assemblée Générale
de l'Union Géodésique et Géophysique Internationale,
qui s'est réunie du 17 au 25 Septembre 1933
à Lisbonne dans le Palais du Congrès.



Digitized by the Internet Archive
in 2025

https://archive.org/details/proces-verbaux-association-oceanographie-physique_1934_1

Table des Matières.

Pag.

Les Comités de l'Association 7

Agenda de l'Assemblée 10

First General Sitting 11

Second General Sitting 15

Third General Sitting 18

Fourth General Sitting 21

Appendices:

1. Statuts de l'Association 29
2. Rapport sur le Travail et les Finances 32
3. The third International Hydrographic Conference at Monaco 37
4. Manual for Scientific Observations 39
5. Oceanographical Bibliography 40
6. Mean Sea Level and its Changes 41
7. La Balance de l'acide carbonique 45
8. On Determination of Mixing in the Sea 48
9. Thalassological Work in Finland 54

Le Comité Exécutif:

Président: M. Martin Knudsen, Prof., Polyteknisk Laereanstalt, Copenhague.

Vice Président: M. E. Fichot, Membre de l'Institut, 47, Avenue de Neuilly, Neuilly sur Seine (Seine).

Secrétaire: M. Rolf Witting, Prof., 2, Rue de l'Observatoire, Helsingfors.

Membres: M. Odón de Buen, Prof., Lagasca 116, Madrid.

M. E. Caballero y Lastres, Contre-Amiral, 40, Rue de France, Nice (A. M.)

M. L. Joubin, Prof., Membre de l'Institut, 55, Rue du Buffon, Paris.

M. G. W. Littlehales, Dr., Hydrographic Office, Washington, D. C.

M. G. Magrini, Prof., Stra, Venezia.

M. D. J. Matthews, Admiralty, London S. W. 1.

Les Comités de l'Association.

Comité des Marées (*Tidal Committee*) Prof. H. Lamb, Honorary President; M. E. Fichot, President; Prof. J. Proudman, Secretary; MM. H. A. Marmer, S. Ogura, F. Vercelli, R. Witting (Prague 1927) et MM. J. L. H. Luymes, J. P. Jacobsen, H. U. Sverdrup (Stockholm 1930).

Adresse: University of Liverpool.

Comité préliminaire pour fixer la teneur des articles de l'Encyclopédie et pour le Manuel pour les observations scientifiques en mer. (Stockholm 1930).

M. E. Fichot, Président; MM. Rafael de Buen, M. Knudsen, J. Proudman, F. Vercelli, R. Witting et G. Magrini (Secrétaire).

Adresse: M. Fichot ou M. Magrini.

Comité chargé de la Publication de la Bibliographie (Stockholm 1930): M. le Professeur G. Magrini, Stra, Venezia.

Commission mixte permanente chargée de réunir des documents utiles pour l'étude du phénomène *des Raz de Marée.* (Prague 1927) Associations d'Océanographie physique, de Météorologie, de Seismologie, et de Volcanologie. Prof. A. Imamura, Président; Prof. H. Hubert, Secrétaire. Adresse: Prof. H. Hubert, 5, Rue Raynouard, Paris. 16.

Commission mixte permanente ayant pour objet l'étude *de l'influence des glaces polaires sur les climats,* surtout dans l'hémisphère sud. (Prague 1927) Associations d'Océanographie physique et de Météorologie.

Les Comités nationaux:

Canada: Président: Dr. W. Bell Dawson, 7, Grove Park, Westmouth, P. Q. Secrétaire: Captain F. Anderson.
Adresse: Captain F. Anderson, the Hydrographer, Canadian Hydrographic Service, Department of Marine, Ottawa, Canada.

Danemark: Président: Prof. Martin Knudsen. Secrétaire: Dr. J. P. Jacobsen.
Adresse: Prof. Martin Knudsen. Polyteknisk Laereanstalt, Copenhague, K.

Espagne: Président: Prof. Odón de Buen. Secrétaire: Prof. Rafael de Buen.
Adresse: Instituto español de Oceanografia, Alcalá 31, Madrid.

Etats-Unis: Président: Dr. H. B. Bigelow. Secrétaire: Mr. C. O. Iselin.
Adresse: Dr. H. B. Bigelow. Museum of Comparative Zoology. Cambridge, Mass. U. S. A.

France: Président: M. E. Fichot, Membre de l'Institut. Secrétaire: M. C. Vallaux.
Adresse: M. E. Fichot. 47, Avenue de Neuilly, Neuilly sur Seine (Seine).

Finlande: Président: Prof. Rolf Witting. Secrétaire: Dr. S. E. Stenij.
Adresse: Prof. Rolf Witting, Rue de l'Observatoire 2. Helsingfors.

Grande-Bretagne: Président: Captain T. A. Edgell. Secrétaire: Mr. D. J. Matthews.
Adresse: D. J. Matthews, Esq., Hydrographic Department, Admiralty, London.

Japon: Président: M. Takematu Okada. Secrétaire: Vacant. Adresse: M. Y. Ishimaru, Secretary, National Research Council, Imperial Academy House, Ueno Park, Tokyo.

Maroc: Président: Dr. Jacques Liouville. Secrétaire: Lieutenant de Vaisseau Georges Roux.
Adresse: Chef du Service Océanographique, Institut Scientifique Chérifien, 2, Rue de Foucauld, Casablanca.

Norvège: Président: Prof. Bj. Helland-Hansen. Secrétaire: Prof. H. U. Sverdrup.
Adresse: Prof. H. U. Sverdrup, Geofysisk Institutt, Bergen.

Pays-Bas: (Comité géophysique général) Président: Prof. E. van Everdingen. Secrétaire: Dr. C. Braak.
Adresse: Dr. C. Braak, Kon. Nederl. Meteor. Inst., De Bilt.

Portugal: Président: Comm. J. A. Wills de Araujo. Secrétaire: Dr. A. Ramalho.
Adresse: Dr. A. Ramalho, Aquario Vasco da Gama, Dàfundo, Lisboa.

Agenda.

1) Allocution du Président.
2) Inscription des participants de chaque pays, délégués et experts.
3) Statuts de l'Association.
4) Constitution définitive de l'Association.
5) Rapport sur le travail et les finances.
6) Rapport de la Commission représentant l'Association à la Conférence hydrographique internationale à Monaco 1932 avril.
7) Rapport de la Commission des Marées.
8) Rapport de la Commission préliminaire pour fixer la teneur des articles de l'Encyclopédie et pour le Manuel pour les observations scientifiques en mer.
9) Rapport sur la Bibliographie.
10) Communication sur la Carte générale bathymétrique des Océans.
11) Les observations du Niveau des mers. Unification et développement du réseau mondial des stations.
12) Rapport de la Commission pour l'étude des Raz de marée.
13) Rapport de la Commission pour l'étude de l'Influence des glaces polaires sur le climat.
14) Proposition d'instituer une Commission mixte pour l'étude des problèmes de l'écorce de la terre (Ass. d'Océan. phys., de Géodesie, de Seismologie et de Vulcanologie).
15) Rapports abrégés sur le travail après la réunion de Stockholm dans les pays différents.
16) Rapports et lectures sur des travaux spéciaux par les membres de l'Association.
17) Discussion de la possibilité de coordonner les travaux des grandes expéditions océanographiques.
18) Suggestions et propositions faites par les Comités nationaux ou par les membres de l'Association.
19) La mode de publication des actes de l'Association.
20) Le budget pour la période suivante.
21) Elections.

First General Sitting of the Association.

Monday 18th. September 1933.

The first General Sitting of the »Association Internationale d'Océanographie Physique», took place in one of the rooms of the Palace of the Congress of the Republic. Prof. M. Knudsen (Denmark) took the chair and opened the sitting at 11 a.m. There were present:

Great Britain —	Mr. D. J. Matthews
	Prof. J. Proudman
Italy —	Com.ore V. Magliocco
	Prof. F. Vercelli
Norway —	Prof. B. Helland-Hansen
Portugal —	Dr. A. Ramalho
Spain —	Prof. Odón de Buen
	Prof. Rafael de Buen
	C.te Rafael Estrada
United States —	Capt. David Le Breton
	Prof. Thomas G. Thompson

Prof. A. Defant, Director of the »Institut für Meereskunde», Berlin, as guest.

Point 1 of the Agenda: President's address

»Messieurs

C'est avec une vive satisfaction que j'ai l'honneur de vous souhaiter la bienvenue à cette réunion. Je vous remercie de tout coeur d'être venus ici et j'exprime le voeu que nos délibérations soient fructueuses. Il me semble que nous sommes assez nombreux et que nous sommes réunis ici dans des circonstances si favorables que nous avons le droit d'espérer de bons résultats de notre travail.

Tout d'abord je vous rappelle notre agréable séjour à Stockholm il-y-a trois ans, mais il faut reconnaître que dans cet espace

de temps notre association a subi des pertes douloureuses. Nous avons à regretter la perte du professeur *Johs. Schmidt* de Copenhague, membre de notre comité exécutif, ainsi que la perte du professeur *C. H. Ostenfeld*, le bien connu plantologue, également de Copenhague. Le temps ne me permet pas de m'arrêter aux oeuvres de ces collègues défunts; leur valeur du reste est assez bien connue!

En 1930 à la réunion plénière de l'Union, à Stockholm, les nouveaux statuts de l'Union furent adoptés. Je vous rappelle seulement le no. 10 de ces statuts qui est ainsi formulé:

> »Chaque Association élit son Bureau, formé du Président, du Secrétaire et, le cas échéant, de Vice-Présidents. Elle établit librement ses propres Statuts, sous la seule réserve qu'ils ne contiennent aucune disposition contraire aux Statuts de l'Union.»

En accord avec cette résolution, notre Association a élu son Bureau (comité exécutif) déjà à la séance à Stockholm mais le temps et les circonstances n'ont pas permis d'établir les statuts de l'Association. Le résultat en a été que pendant les trois dernières années notre Association n'a pas eu de statuts et pour cette raison le Bureau a dû limiter ses actions à un minimum. Une autre raison a été que l'Allemagne et d'autres pays centraux ne font pas encore partie de l'Union et non plus de notre Association. J'ose dire que j'attribue une très grande importance à cette dernière raison et j'exprime le voeu sincère que notre Association ne tarde pas a prendre une forme vraiment internationale, condition nécessaire pour des travaux féconds dans l'avenir. Je suis heureux de constater que *M. Defant* a accepté de prendre part à nos délibérations:

> »Herr Dr. Defant. Namens der Association danke ich Ihnen, dass Sie gekommen sind, und wir bitten Sie zu tun, was Ihnen möglich ist, damit Ihr Land als ordinäres Mitglied in die Union und auch in unsere Association eintritt».

Le Secrétaire, *M. Witting*, a envoyé un rapport sur le travail de Bureau pendant les trois dernières années, mais je tiens à vous dire dès le début que l'Association ne peut pas continuer son existence sans statuts. Il nous faut faire ici nos statuts et le Bureau a jugé que son devoir le plus important était de faire les travaux préparatoires pour trouver, autant que possible, le moyen de sortir

de la position génante dans laquelle nous nous trouvons à present. Vous trouverez donc devant vous, Messieurs, les projets des Statuts que nous allons discuter tantôt.

Je regrette d'avoir à vous informer que le secrétaire, M. Witting, n'est pas encore arrivé et qu'il est peu vraisemblable qu'il arrive. Il m'a autorisé à vous remercier, de sa part, de la confiance que vous lui avez témoignée et à vous dire combien il regrette que ses devoirs, comme Ministre des finances en Finlande, l'empêchent de continuer son travail comme secrétaire de l'Association.

Je suis certain d'être d'accord avec vous tous en proposant de remercier le professeur Witting de ce qu'il a fait pour nous et en lui exprimant nos vifs regrets qu'il ne puisse pas être avec nous à cette occasion. (Applaudissements).

Comme il nous faut avoir un secrétaire comme substitut du professeur Witting pendant cette séance à Lisbonne, je me permets de proposer le *Dr. Ramalho* qui est ici chez lui. S'il n'y a pas d'objection, »je vous demande donc, M. Ramalho, de vouloir bien nous rendre ce service en plus des services que vous nous avez déjà rendus».

Ne voulant pas anticiper les points divers de notre ordre du jour, je me bornerais à vous souhaiter encore une fois la bienvenue.»

Dr. Ramalho expressed his thanks for the honour conferred upon him and assumed the place of Secretary.

Point 2 of the Agenda: Register of the representatives of each country. (see above list)

The President announced the dates, times and place for the sittings of the »Raz de Marée» Committee (19th. September at 8.30 a.m. at the Palace of the Congress) and »Tidal Committee» (same day, at 11 a.m. in the same room).

Point 3 of the Agenda: Statutes of the Association.

The President opened the discussion on the Statutes of the Association, drafted by the Executive Committee and circulated during October 1932 among the known National Oceanographical Committees, the various national representatives of the Union, etc., and generally, among oceanographers of sundry countries, as indicated in the Report of the Secretary of the Association.

Several amendments and corrections were suggested by various delegates and the draft was finally approved with the following alterations:

Sub-section 3 — The word »partiellement» was deleted in line 3.
Sub-section 4 — The word »océanographiques» was added in the Sub-section heading and in lines 1 and 5 after the words »comités nationaux».
Sub-section 5 — The phrase »dirigés par» in line 1 was replaced by »confiés à».
Sub-section 6 — The word »partiellement» in line 12 was deleted. The paragraph beginning: »pour les questions administratives . . .» was replaced by:
»Sur les questions administratives concernant les contributions financières de la part de l'Union les voix sont pris selon la manière prescrite dans les statuts de l'Union».
Sub-section 8 — The date (left blank in the draft) on which the Statutes should come into force, was entered as 20th. September 1933.

The phrase »proposé par une Assemblée générale» was added after »Aucun changement» in line 4 and »adhérents à l'Association» after »voix des membres» in line 6.

The sitting adjourned at 12.30 p.m. and a second sitting was announced for the same day at 3.30 p.m. at the Vasco da Gama Aquarium, Dàfundo.

Second General Sitting.

Monday 18th. September 1933.

The Association met in the Library of the Vasco da Gama Aquarium, Prof. M. Knudsen taking the chair at 3.30 p.m.

The following delegates were present:

Great Britain —	Mr. D. J. Matthews
	Prof. J. Proudman
	Sir Gilbert Walker
Italy —	Prof. F. Vercelli
Norway —	Prof. B. Helland-Hansen
Portugal —	Dr. A. Ramalho
Spain —	Prof. Odón de Buen
	Prof. Rafael de Buen
	C.te Rafael Estrada
United States —	Capt. David Le Breton
	Prof. Thomas G. Thompson

Prof. A. Defant, Director of the »Institut für Meereskunde», Berlin, as guest.

The President suggested that Points 4—9 of the Agenda should be postponed for another sitting and that the subject under Point 10 should be discussed.

Point 10 of the Agenda: Communication regarding the »Carte Bathymétrique Générale des Océans»

Prof. Odón de Buen reported the proceedings on the subject at the meeting of the Sub-Committee of the Bathymetrical Chart, during the Third International Hydrographic Conference held at Monaco in April 1932 and read the communication of M. de Vanssay de Blavous at that meeting. This communication has been printed in: *Report Third Internat. Hydrog. Conf. Monaco* 1932 page 262.

Prof. Odón de Buen called special attention to the difficulties, monetary and otherwise, with which the Bureau Hydrographique International is faced in connection with the publication of a revised edition of the Carte Bathymétrique Générale des Océans. He further quoted a resolution passed at the final General Meeting of the Fifth Pacific Science Congress (Victoria and Vancouver, June 1933) and proposed that the Association should pass a similar resolution.

The following statement was approved:

»The International Association of Physical Oceanography expresses its appreciation of the efforts which are being made by the International Hydrographic Bureau towards the publication of a revised edition of the Carte Bathymétrique Générale des Océans. It declares its sense of the value which such publication would have for the Science of Oceanography and hopes that the publication will not be unduly delayed by lack of financial resources».

The sitting proceeded to discuss:

Point 15: Summary of reports on the work achieved in various countries, subsequent to the Stockholm Meeting.

The only printed report received was on »Thalassological Work in Finland» by R. Witting and G. Granqvist, which had previously been circulated among the delegates present (Appendix 9).

Commander R. Estrada (Spain) read and distributed a typewritten list of the work of the »Servicio Hidrografico Español» during the past three years (1931—33) and submitted a Note from M. W. Benitez entitled »Influencia de la carga de mareas del mar, sobre la inclinación notada en el Observatorio de Marina en San Fernando».

Prof. Rafael de Buen (Spain) presented various Papers published by the Instituto Español Oceanografico and by the Consejo Oceanografico Ibero-Americano, as well as the Report of the Proceedings of the »Congresso Internacional de Oceanografia» held at Seville in May 1929, the publication of which had been delayed. This completed the account of the Spanish oceanographical researches after the Stockholm meeting (1930).

Prof. Rafael de Buen pointed out that no. 62 of »Notas y Resumenes» of the Instituto Español de Oceanografia, constitutes an actual detailed report of Spanish oceanographical research.

Commander Le Breton read a Paper on »Bathymetry and water circulation of the North Pacific Ocean, and gravity investigations of the West Indies region» by the U. S. Hydrographic Office, Navy Department, Washington, D. C., illustrated by lantern slides. He further presented two publications, entitled »The Gravity Measuring Cruise of the U. S. Submarine S-21», by F. A. Vening Meinesz and F. E. Wright, »With an Appendix on Computational Procedure», by Miss Eleanor A. Lamson and »List of Oceanic depths, 1931, North Pacific Ocean».

Point 16 of the Agenda: Reports and lectures on special researches

Two printed reports »Étude Systématique de balance de l'acide carbonique entre la mer et l'atmosphère», proposé par Kurt Buch et Rolf Witting and »On Determination of Mixing in the Sea» by Rolf Witting, were previously distributed. (Appendices 7, 8).

Prof. Defant read a Paper on »Die innere Gezeitenwellen im Atlantischen Ozean auf Ankerstationen des 'Meteor'», illustrated by lantern slides.

The sitting was adjourned at 6 p.m.

Third General Sitting.

Wednesday 20th. September 1933.

The Third General Sitting of the Association was held in the Library of the Vasco da Gama Aquarium. Prof. M. Knudsen (Denmark) took the chair and opened the sitting at 9.30 a.m.

There were present:

Great Britain —	Mr. D. J. Matthews
	Prof. J. Proudman
Norway —	Prof. B. Helland-Hansen
Portugal —	Dr. A. Ramalho
Spain —	Prof. Rafael de Buen
	C.te Rafael Estrada
United States —	Capt. David Le Breton

Prof. A. Defant, Director of the »Institut für Meereskunde», Berlin, as guest.

Point 4 of the Agenda: »Definite constitution of the Association»

The President declared the Association to be duly constituted, the Statutes being those approved at the first sitting. (Appendix 1).

Point 5 of the Agenda: Report of work and financial position. (Appendix 2).

The report of work and financial position (previously distributed, in printed form, among all the delegates present) was duly considered and a committee, composed of Messrs. Proudman and Matthews was appointed to verify the documents in question.

Point 6 of the Agenda: »Report to the Association from its representatives to the Third Hydrographic Conference held at Monaco in April 1932». (Appendix 3).

This report had also been previously distributed to all the delegates present and was duly considered.

Point 8 of the Agenda: Publication of the First Volume of the Manual for Scientific Observations on the Seas.

A printed Circular Letter from Prof. G. Magrini, dated 10th. September 1933, on the above subject, was read and distributed. (Appendix 4)

Prof. G. Magrini further sent several specimen proofs of the chapter on »Morphologie et Nomenclature du Relief Sous-Marin», by EM. de Martonne.

Point 9 of the Agenda: Publication of the »Bibliographia Oceanographica».

A printed Circular Letter from Prof. G. Magrini, also dated 10th. September 1933, on the above subject, was read and distributed. (Appendix 5). The first three volumes of the »Bibliographia Oceanographia» relative to 1928, 29 and 30 respectively, have already been published and several copies were sent to the Association. Copies of the first eight folios of volume 4 (1931) covering pages 1 to 128 were also received.

Point 11 of the Agenda: Mean Sea Level and its Changes.

A printed Memorandum on »Mean Sea Level and its Changes» by R. Witting was considered. (Appendix 6)

It was agreed to appoint a Committee on this subject and to ask for the collaboration of the Association of Geodesy and of the International Hydrographic Bureau of Monaco.

It was further agreed that MM. Witting and Proudman should represent the Association of Physical Oceanography on this Committee.

Point 16 of the Agenda: Reports and Lectures on Special Researches.

Dr. Ramalho demonstrated a working model showing the general lines of the oceanographic conditions existing between the Mediterranean Sea and the Gulf of Gibraltar, through the Straits of Gibraltar, causing the inflow of surface Atlantic water into the Mediterranean and the outflow of Mediterranean water, near the

bottom of the Straits, and its outwards spreading as intermediate layers of higher temperature and salinity.

Dr. Ramalho also showed a relief-map of the great sub-marine valley of Nazaré (coast of Portugal), based on the survey made by the »Missão Hidrográfica da Costa de Portugal».

Prof. Helland-Hansen gave a lecture on »A method for the dynamic calculation of currents near the edge of the continental shelf».

Mr. D. J. Matthews spoke on »Two sections across the Atlantic made by H. M. S. 'Challenger' in 1932», and exhibited several charts and lantern slides.

The sitting adjourned at 12.30.

Fourth General Sitting.

Thursday 21st. September 1933.

The Fourth General Sitting of the Association was held in one of the Committee Rooms of the Palace of the Congress of the Republic. Prof. M. Knudsen (Denmark) took the chair and opened the sitting at 10 a.m.

There were present:

Great Britain —	Mr. D. J. Matthews
	Prof. J. Proudman
Norway —	Prof. B. Helland-Hansen
Portugal —	Dr. A. Ramalho
Spain —	Prof. Odón de Buen
	Prof. Rafael de Buen
	C.te Rafael Estrada
Switzerland —	Dr. Paul L. Mercanton
United States —	Capt. David Le Breton
	Prof. Thomas G. Thompson

Prof. A. Defant, Director of the »Institut für Meereskunde», Berlin, as guest.

Point 7 of the Agenda: Report of Committee on Tides

Professor Proudman read the following Report, which was approved.

»*Report of Committee on Tides*» — A meeting of the Committee was held on September 19th. 1933 at 11 a.m., there being present:

Prof. Proudman (acting Chairman)

Prof. Vercelli (acting Secretary), Messrs. Defant, Ramalho, Tenani, Tomaz, Tomaschek.

1. — As Secretary of the Permanent Committee, Prof. Proudman read the following report:

'At the meeting at Stockholm it was agreed to increase the membership of the permanent Committee; of the gentlemen there

nominated, MM. J. P. Jacobsen, J. L. H. Luymes and H. U. Sverdrup agreed to serve, but Dr. H. Thorade regretfully found himself unable to do so.

At the meeting at Stockholm it was also agreed to ask the International Hydrographic Bureau of Monaco if it would undertake the collection and publication of information relating to existing records of observation of sea level and to national tidal services. The Secretary of the Committee duly conveyed this request to the Bureau and the Bureau offered to undertake the task. The Bureau has since carried out this work in a most admirable manner and much valuable information of the type in question is now available in various numbers of the Hydrographic Review published by the Bureau.

The second instalment of the Committee's Tidal Bibliography was published from Venice in 1931 as '*Bulletin N. 17*' of the Section of Oceanography. A third instalment was published from Helsingfors in 1932 as '*Publication Scientifique No. 2*' of the Association of Physical Oceanography. In the compilation of these instalments the members of the Committee rendered much assistance. In the '*Bibliographia Oceanographica*' issued annually since 1928 by Professor Magrini, publications on tides and kindred matters are included. It therefore appears no longer desirable for this Committee to attempt to issue the instalments of its Bibliography at frequent intervals. But it seems to the Secretary that the special arrangement of this Bibliography is well adapted for classifying the publications issued over a period of years and he therefore proposes to the Committee that in future the Bibliography be issued every three years.

The 'Historical review of dynamical explanations of tides and seiches in narrow seas and lakes' by S. F. Grace and the Secretary, was issued in 1930 from Venice as '*Bulletin N. 15*' of the Section, while two similar reports by S. F. Grace —

I. 'Historical review of dynamical explanations of tides in non-elongated seas and lakes'

II. 'Historical review of dynamical explanations of the tides of the Mediterranean, the Baltic Sea, the Gulf of Mexico and the Arctic Ocean'

were issued in 1931 from Helsingfors as '*Publication Scientifique No. 1*' of the Association.

J. Proudman»

2. — It was agreed to pass the following resolution:

»The Committee places on record its appreciation of the active response made by the International Hydrographic Bureau to the Committee's representation regarding the collection and publication of information relating to existing records of observation of sea level and to national tidal services. The Bureau's *'General repertory of tidal authorities and tidal records'* is of much value to those engaged in the study of the distribution of sea level and tides».

3. — It was agreed that the Tidal Bibliography should be issued according to the proposal made in the Secretary's report.

4. — It was agreed that Reports on tidal research, similar to those already published, should be issued as circumstances permit.

5. — Prof. Proudman submitted the following financial report, together with details of the Accounts. These were accepted.

RECEIPTS:

From Secretary of Association, 23. 10. 31	£ 10.0.0.

EXPENDITURE:

Balance due to J. Proudman, 1. 8. 30	6.11.
Secretarial Assistance during period	5.2. 6.
Postage during period	1.0. 5.
Material	3. 4.
Balance in hand, 31. 7. 33	3.6.10.
	£ 10.0. 0.

6. — It was agreed to recommend that the officers and members of the permanent Committee should be as follows:

COMMITTEE ON TIDES

Honorary President	H. Lamb.
President	E. Fichot.
Secretary	J. Proudman.

MEMBERS

A. Courtier
R. Estrada
J. E. Fjeldstad
J. P. Jacobsen

MEMBERS

J. L. H. Luymes
H. A. Marmer
S. Ogura
H. U. Sverdrup
M. Tenani
H. Thorade
A. R. Tomaz
F. Vercelli
R. Witting.

Point 12 of the Agenda:

Mr. Henry Hubert, Secretary of the »Comité pour l'Étude des Raz de Marée», gave a short account of the work of the Committee and on its behalf he requested that the Association should keep up the annual subsidy to the Committee, amounting to 2,125 French francs (equivalent to 425 Swiss Francs). This was agreed to, provided that the resources of the Association were adequate.

Point 13 of the Agenda: Report of the Committee for the Study of the Influence of the Polar Seas on Climate.

No report was submitted.

Point 14 of the Agenda: »Comité des Marées de l'Écorce terrestre».

The following report was read:

»La Commission des Marées de l'Écorce terrestre s'est réunie le mardi 19 Septembre 1933, à 9 heures 30.

Étaient présents:

MM. W. D. Lambert, faisant fonctions de Président et de Secrétaire, L. Carnera, D. J. Matthews, J. Proudman, R. Tomaschek, Jean Vignal.

M. le Président resume son Rapport.

Ce rapport pourra être distribué à toutes les personnes qui en feront la demande.

Après un échange de vues, la Commission exprime le désir qu'une séance commune ait lieu entre les Associations de Géodésie, Séismologie, Volcanologie et Océanographie Physique, conformément aux prévisions du programme de l'Association de Géodésie.

Les personnes présentes pour agir dans ce sens auprès des personnalités compétentes des Associations précitées.

La Commission est d'avis de soumettre le voeu suivant aux Associations en question, si elles peuvent avoir une séance commune, et à défaut à l'Association de Géodésie.

»Les Associations . . . . .

expriment le voeu que des postes temporaires d'observations gravimétriques, comportant des appareils de mesure des variations de la verticale, soient installés dans les conditions suivantes:

a) en vue de l'étude des mouvements généraux des continents en croix à travers un continent, de préférence à travers l'Amérique du Nord;

b) en vue de l'étude des mouvements régionaux, en des points relativement variés, distants de 200 à 300 km.;

c) en vue de l'étude des marées en pleine mer, sur une ligne d'îles isolées;

d) enfin, plus spécialement dans des régions séismiques.»

Walter D. Lambert.

Point 16 of the Agenda:

Prof. Thomas G. Thompson gave a short lecture on the organisation of United States Oceanographical Research on the Pacific coast of the American Continent and on the work of the University of Washington, Seattle.

Professor Vercelli gave an account of the methods employed in the researches which he is making on the absorption of light by sea water at various depths in the Adriatic. He described and showed various photographs of a new apparatus which he has invented.

Prof. Paul L. Mercanton gave a summary of his researches during 1929 and 1931 in Icelandic and Greenlandic waters, in which he employed the »Pycnosondeur de La Cour et Schou». He took part in the Arctic cruises of the »Pourquoi Pas?», Commander Charcot's vessel, and was accordingly able to determine the distribution of water densities in the Scoresbysund and especially in Eyafjord.

Prof. Defant gave an account of the researches undertaken by the »Institut für Meereskunde», Berlin, (Frl. Dr. L. Möller), in collaboration with the »Physikalisch-Technische Reichsanstalt», on physical and chemical methods of determining the density of sea-water.

The Association considered these investigations as being very important and recommended their furtherance on the largest possible basis. In particular, the Association held that it would be highly desirable to design a suitable interferometer, for use on board ships, whereby a rapid examination of a great many samples could be made.

Prof. Rafael de Buen expressed a hope that the refractometric method (Pulfrich apparatus) for the indirect determination of sea water density would be studied in the oceanographical laboratories of all the interested countries, especially in view of its accuracy. This opinion was upheld by the Association.

Point 19 of the Agenda: Publication of the Reports of Proceedings of the Association.

The Association approved the publication of the Reports of Proceedings in two series, viz.: »Publications Scientifiques» and »Procès-Verbaux»; Nos. 1 and 2 of the first series have already been distributed.

Point 20 of the Agenda: Budget of the Association.

Under this heading, the President stated that the subscriptions to be paid in future by each member had not as yet been definitely fixed by the *Union*, but that there had been a proposal that they should be lower than heretofore.

The Association, however, held that it was entitled to about ten per cent of the income of the Union. In any case it could not see its way to reducing its annual budget to less than 12,000 Swiss francs.

As under the circumstances, the Association could not draw up a Budget, the President and the Secretary were requested to prepare an estimate, subject to discussion by correspondence with the other members of the Executive Committee. If necessary a meeting could be called, of as many of the members of the Executive Committee as might be conveniently summoned.

Point 21 of the Agenda: Election of Officers.

The countries represented at the time of polling were as follows:

Denmark —	Prof. Knudsen
Great Britain —	Mr. D. J. Matthews
Italy —	Prof. Vercelli
Norway —	Prof. B. Helland-Hansen
Portugal —	Dr. A. Ramalho
Spain —	Prof. Odón de Buen
United States —	Capt. David Le Breton

The »Amendment provisoire» of the Statutes, adopted at the first sitting, was as follows:

»Après l'adoption de ces noveaux Statuts le Comité Exécutif sera entièrement reconstitué, sans qu'il soit tenu compte de restrictions de rééligibilité.

Des huit membres du Comité Exécutif ainsi reconstitué quatre se retireront après l'expiration d'une période sans pouvoir être réélus immédiatement. Ces quatre membres seront désignés par voie de tirage au sort, effectué immédiatement après l'élection.»

Prof. M. Knudsen was elected President by the unanimous vote of all those present, with the exception of Denmark and Italy, who refrained from voting.

M. E. Fichot and Prof. Proudman were elected, respectively, Vice-President and Secretary, by the unanimous vote of all those present, with the exception of Italy, who refrained from voting.

The following persons were elected Members of the Executive Committee:

Finland —	Prof. R. Witting
France —	Prof. L. Joubin
Great Britain —	Mr. D. J. Matthews
Italy —	Prof. G. Magrini
Norway —	Prof. B. Helland-Hansen
Peru —	Mr. E. Caballero y Lastres
Spain —	Prof. Odón de Buen
United States —	Prof. Thomas G. Thompson

by the unanimous vote of those present, with the exception of Italy, who abstained from voting in every case and Portugal, who abstained from voting in the case of the representative of Peru.

The order of cessation of office of the various Members of the Executive Committee was drawn by lot, it being first

agreed that Nos. 1, 2, 3, 4 should serve for two periods. The results were as follows:

1.	Prof. L. Joubin	to serve for two periods.
2.	Prof. R. Witting	
3.	Mr. Caballero y Lastres	
4.	Mr. D. J. Matthews	
5.	Prof. G. Magrini	to serve for one period.
6.	Prof. Odón de Buen	
7.	Prof. B. Helland-Hansen	
8.	Prof. Thomas G. Thompson.	

The President declared that as the »Amendment provisoire» had now served its purpose, it could be omitted in the definitive form of the Statutes.

The Association, in accordance with Article 3 of the Statutes, expressed a wish that the following international bodies, occupied with the study of Physical Oceanography, should be invited to become Members of the Association:

1) — Conseil Permanent International pour l'Exploration de la Mer;
2) — Commission Internationale pour l'Exploration Scientifique de la Mer Mediterranée;
3) — Consejo Oceanografico Ibero-Americano;
4) — Bureau Hydrographique International;
5) — International Committee on the Oceanography of the Pacific;
6) — International Ice Observation and Ice Patrol Service in the North Atlantic Ocean.

A cordial vote of thanks was passed to Dr. Ramalho for the admirable way in which he had discharged the duties of Secretary to the General Assembly of the Association.

All business being transacted, the President declared the Sitting to be closed.

Appendix 1.

Statuts de l'Association Internationale d'Océanographie Physique

adoptés à l'Assemblée Générale à Lisbonne Septembre 1933.

1. But de l'Association.

Ce but est exprimé dans les Statuts de l'Union, § 1 se rapportant aux objets plus spéciaux de l'Association.

2. Objets de l'Association.

Les sujets dont s'occupe l'Association sont définis par le nom de celle-ci. Ils comprennent principalement les parties de l'océanographie dans lesquelles on utilise les mathématiques, la physique et la chimie pour l'étude scientifique de la mer.

3. Membres de l'Association.

Les pays qui adhèrent à l'Union Géodésique et Géophysique Internationale ont le droit de s'inscrire comme membres de l'Association. Des organismes internationaux qui s'occupent d'océanographie physique peuvent aussi être admis comme membres par résolution d'une assemblée générale de l'Association.

4. Comités nationaux océanographiques.

Un comité national océanographique est constitué dans chacun des pays qui s'est inscrit comme membre de l'Association. Il est créé sur l'initiative du Comité National Géodésique et Géophysique.

Les comités nationaux océanographiques ont le devoir de provoquer et de coordonner chacun dans son pays des recherches en accord avec les buts de l'Association. Les comités nationaux, ainsi que les organismes internationaux adhérents ont le droit de soumettre à l'Association des questions à discuter rentrant dans la compétence de celle-ci.

5. Administration de l'Association.

Les travaux de l'Association sont confiés à l'Assemblée générale des délégués choisis par les membres de l'Association. L'in-

tervalle entre deux Assemblées générales ordinaires consecutives est appelé une période.

L'Association a un Comité Exécutif qui est formé d'un président, d'un vice-président, d'un secrétaire-général et de membres, dont le nombre ne doit pas dépasser huit. Le président reste en fonction pour une période seulement et n'est rééligible qu'après l'expiration de la période suivante. Le vice-président reste en fonction pour deux périodes et n'est rééligible qu'après l'expiration de la période suivante. Le secrétaire-général se retire après deux périodes et peut être réélu immédiatement et à une Assemblée générale suivante quelconque. Les membres du Comité Exécutif ayant fonctionné durant deux périodes successives se retirent et ne peuvent être réélus qu'après l'expiration d'une nouvelle période.

Le transfert des pouvoirs à un nouveau Comité Exécutif se fait trois mois après l'élection.

Le président préside les séances de l'Assemblée générale ainsi que celles du Comité Exécutif. Avec le secrétaire-général il prépare et organise ces séances. Le secrétaire-général est chargé de la correspondance, de la conservation des archives ainsi que de la préparation et de la distribution des procès-verbaux et des publications. Selon les instructions du Comité Exécutif le secrétaire-général gère les ressources de l'Association.

L'Assemblée générale ainsi que le Comité Exécutif peuvent confier à des commissions spéciales ou à des particuliers certaines tâches qui se rapportent à des sujets rentrant dans la compétence de l'Association. Celui qui est chargé d'une telle tâche a le devoir de faire un rapport sur son travail à chaque Assemblée générale.

6. Assemblées de l'Association.

Une Assemblée générale ordinaire se tient à l'occasion de l'Assemblée générale ordinaire de l'Union Géodésique et Géophysique Internationale.

Dans des cas spéciaux le président de l'Association peut, avec le consentement du Comité Exécutif, convoquer une Assemblée genérale extraordinaire. Il est tenu de le faire à la demande d'un tiers des voix des membres.

Le nombre des délégués envoyés aux Assemblées générales par les membres de l'Association n'est pas limité.

Sauf dans le cas de modification des Statuts, les résolutions sont prises à la majorité des voix. Tous les délégués présents ont

chacun une voix sur les questions non administratives. Sur les questions administratives chaque membre (pays et autres) n'a qu'une seule voix. Au nombre des questions administratives on compte l'admission des organismes internationaux, l'élection des membres du Comité Exécutif et, le cas échéant, d'autres questions selon la décision du président.

Sur les questions administratives concernant les contributions financières de la part de l'Union les voix sont pris selon la manière prescrite dans les statuts de l'Union.

En toutes circonstances s'il y a égalité de voix, celle du président est prépondérante.

Avec le consentement du Comité Exécutif, le président peut inviter à assister aux séances de l'Assemblée générale des représentants des institutions ou des particuliers.

L'ordre du jour d'une Assemblée générale est fixé par le Comité Exécutif et communiqué aux membres pour le moins quatre mois avant l'ouverture de la session. Toute question ne figurant pas à l'ordre du jour n'est prise en considération qu'avec l'assentiment préalable de l'Assemblée générale.

7. Budget.

Avec l'assistance du secrétaire-général le Comité Exécutif prépare un budget de prévision pour chaque année. Les comptes sont rendus à l'Assemblée générale qui nomme une Commission financière. Celle-ci étudie les comptes et en donne rapport à l'Assemblée générale, qui décide.

8. Interprétation et modification des Statuts.

Le présent texte français servira exclusivement pour l'interprétation à donner aux articles de ces Statuts qui entreront en vigeur le 20 Septembre 1933. Au besoin l'Assemblée générale donnera l'interprétation en votant par membres, lesquels n'ont chacun qu'une voix.

Aucun changement proposé par une Assemblée générale ne pourra être apporté aux termes des présents Statuts sans l'approbation des deux tiers des voix des membres adhérents à l'Association. Aucun changement en contradiction avec les Statuts de l'Union Géodésique et Géophysique Internationale n'est possible.

Appendix 2.

Rapport sur le Travail et les Finances par le Secrétaire, donné à la Cinquième Assemblée à Lisbonne 1933.

Par les nouveaux statuts de l'Union, acceptés à l'assemblée à Stockholm en 1930 les anciennes sections furent changées en associations, constituant ensemble l'Union Géodésique et Géophysique Internationale.

Quant à notre association, sa dénomination d'Association d'Océanographie Physique caractérise son ressort de travail comme appartenant au domaine de l'Union Géodésique et Géophysique Internationale et comprenant principalement les parties de l'océanographie dans lesquelles on utilise les mathématiques, la physique et la chimie pour l'étude scientifique de la mer.

La Section d'Océanographie avait travaillé jusqu'ici sans de propres statuts en suivant les dispositions applicables des statuts de l'Union. Il a donc tout d'abord été nécessaire de préciser la forme altérée d'organisation à laquelle répondra l'Association et fixer les normes futures de travail. M. le Président et le Secrétaire avaient à ce but préparé un projet de statuts, qui fut circulé parmi les membres du Comité Exécutif au mois de juillet 1931. En tenant compte des remarques faites les statuts furent modifiés à des entrevues avec M. le Président et M. le Vice-président. Ce projet nouveau de statuts fut envoyé aux membres du Comité Exécutif au mois de mai 1932.

Aucune modification ultérieure n'étant été suggérée, ce projet fut communiqué à tous les organes de l'Association, aux membres du Comité Exécutif, aux comités nationaux océanographiques connus, aux représentants nationaux de l'Union selon la liste jointe

aux procès-verbaux de l'assemblée de l'Union à Stockholm et caetera, en général à plusieurs adresses dans chaque pays. Le projet fut ainsi envoyé aux pays suivants: Allemagne, Argentine, Australie, Autriche, Belgique, Brésil, Bulgarie, Canada, Chili, Danemark, Egypte, Equateur, Espagne, Esthonie, Etats-Unis, Finlande, France, Grande-Bretagne, Grèce, Hongrie, Inde Britannique, Indochine, Italie, Japon, Lettonie, Lithuanie, Maroc, Mexique, Norvège, Nouvelle Zélande, Pays-Bas, Pérou, Pologne, Portugal, Roumanie, Siam, Suède, Suisse, Tchécoslovaquie, Tunisie, Union Sud-Africaine, U. R. S. S., Uruguay et Yougoslavie.

En même temps fut demandé de toutes ces autorités quels pays désiraient actuellement faire partie de l'Association et quels pays avaient déjà un comité national d'océanographie physique en pointant que chaque pays déjà adhéré à l'Union Géodésique et Géophysique Internationale avait le droit de s'inscrire comme membre de l'Association sans payer de cotisation ultérieure.

Une organisation nationale fut rapportée par Canada, Danemark, Espagne, Etats-Unis, France, Finlande, Grande-Bretagne, Japon, Maroc, Norvège, Pays-Bas et plus tard par Portugal. Quelques pays ont fait savoir que la question de l'organisation n'était pas décidée, et quelques pays n'ont pas donné de réponse. L'Australie et l'Union Sud-Africaine ont cessé d'être membres de l'Union.

Au mois d'avril 1933 un circulaire fut distribué nommant les comités de l'Association et les comités nationaux existants, suivi d'un ordre du jour préliminaire pour l'assemblée à Lisbonne. Ce circulaire fut soumis aux membres du Comité Exécutif, aux fonctionnaires des comités de l'Association et aux comités nationaux annoncés avec prière de communiquer les projets de modification et les souhaits éventuels concernant l'ordre du jour avant le 15 juin 1933.

Au commencement d'août 1933 un programme provisoire et un ordre du jour préliminaire nouveau, presque analogue au précédent, fut envoyé aux adresses ci-dessus et aux représentants selon la liste mentionnée de Stockholm et caetera.

En conformité avec les décisions du Comité Exécutif l'Association a été représentée par MM. Fichot, Proudman et Witting à la conférence du Bureau Hydrographique International à Monaco

en avril 1932. Un mémoire spécial donne une relation des procédés à l'assemblée de Monaco. En dehors des sujets y mentionnés la question de la carte bathymétrique mondiale y fut résolue, dont une relation spéciale peut être attendue à Lisbonne. La question d'une terminologie générale pour les glaces maritimes a été discutée mais remise.

Il était aussi l'intention du Comité Exécutif que M. le Président représente l'Association à la Conférence de Consejo Oceanographico Ibero-Americano à Madrid en 1933, laquelle cependant fut ajournée.

A l'occasion d'une entrevue de M. le Président et du Secrétaire à Copenhague en septembre 1931 il fut décidé de publier deux séries, »Publications Scientifiques» à contenir les pamphlets du caractère scientifique et »Procès-Verbaux» à contenir les actes de caractère administratif.

Des Publications Scientifiques ont été imprimés N:o 1, contenant

S. F. GRACE: I. Historical Review of Dynamical Explanations of Tides in Non-Elongated Enclosed Seas and Lakes; II. Historical Review of Dynamical Explanations of the Tides of the Mediterranean, the Baltic Sea, the Gulf of Mexico and the Arctic Ocean,

et N:o 2, contenant

J. PROUDMAN A. O. Tidal Bibliography, 1. Publications issued before 1910, 2. Publications issued during 1929, 3. Publications issued during 1930.

A l'assemblée de l'Union à Stockholm (Procès-Verbaux p. 61) il fut décidé de distribuer les publications à l'aide des comités nationaux. Les publications ont cependant été envoyé directement à plusieurs des adresses données dans la liste de Bulletin de Section d'Océanographie N:o 16. Aux comités nationaux océanographiques annoncés et en quelques pays aux autorités nationales géodésiques et géophysiques un nombre de ces publications a été envoyé pour distribution, en leur faisant part de la distribution déjà exécutée.

L'arrêté de compte de l'Association donné par M. le Secrétaire-général de l'Union le 31 mars 1933 est le suivant:

Créance 1930 IV. 1. . .	Frcs	72,829: 00	Dépenses à Stockholm	Frcs	5,464: 95
Allocation 1930	»	52,624: 00	Au Secrétaire I	»	17,913: 77
Allocation 1931	»	54,220: 00	Au Secrétaire II	»	92,624: 00
			Comm. Raz de Marée	»	2,125: 00
			Excédant	»	61,545: 28
	Frcs	179,673: 00		Frcs	179,673: 00

Créance	Frcs Suisses	12,496: 35	Comm. Raz de Marée	356: 81
Allocation 1932		20,300: 00	Excédant	32,439: 54
		32,796: 35		32,796: 35

Après l'assemblée de Stockholm M. le professeur Magrini a dépensé pour les buts de l'Association de 1 avril à 31 decembre 1930 Lires It. 26,300: 75, correspondant à Lires It. 12,838: 60 de la caisse de l'Association et Lires It. 13,462: 15 = Frcs 17,913: 77, remboursés à lui par M. le Secrétaire-général de l'Union et mentionnés au dessus comme »au Secrétaire I».

Le Secrétaire a reçu de M. le Secrétaire-général de l'Union la somme Frcs 92,624: 00 à deux reprises:

1931 IV 16: Frcs 52,624: 00 à 1.544 (1931 IV 23) = Fmcs 81,251: 45
1932 V 25: Frcs 40,000: 00 à 2.625 (1933 I 21) = Fmcs 105,000: —

En raison des fluctuations monétaires le cheque dernier a été retenu pendant huit mois mais fut encaissé au souhait de M. le Secrétaire-général de l'Union.

La somme des deux rendements est	Fmcs	186,251: 45
Ces moyens ont été déposés dans une banque et ont porté en intérêt moins agio 287: 10 . .	»	8,882: 65
		195,134: 10
Les dépenses jusqu'aujourdhui montent à	»	93,463: 57
Il reste donc au jour qu'il est d'argent comptant dans la caisse de l'Association	»	101,670: 53

à quelle somme on a à ajouter la somme Frcs Suisses 32,439: 54 dans les fonds de l'Union, mentionnée plus haut.

1933. VIII. 26.

Résumé Des Dépenses.

1 Avril 1930 — 26 Août 1933.

1 Avril 1930 — 31 Décembre 1930.

Art. 1. — Frais divers pendant les réunions internationales, Réunion plénière, etc.	Lit.	2414,40
Art. 2. — Frais de publication	»	16138,40
Art. 3. — Bibliothèque centrale	»	1000,00
Art. 5. — Service d'échange des publications .... et 6. Frais de poste	»	675,45
Art. 7. — Fonctionnement du Bureau central	»	4400,00
Art. 10. — Dépenses imprévues	»	1672,50
	Lit.	26300,75

(signé) G. MAGRINI.

1 Janvier 1931 — 26 Août 1933.

Frais du Bureau	Fmcs.	44190.90
Frais de publication	»	8787.00
Frais de voyage	»	38553.17
Commission des Marées	»	1932.50
	Fmcs.	93463.57

Verifié exact,

Helsingfors, Sept. 1933.
(signé) ROLF WITTING.

Liverpool, 3 Oct. 1933.
(signé) J. PROUDMAN.

London, 16 Nov. 1933.
(signé) DONALD J. MATTHEWS.

Appendix 3.

Report to the Association of Physical Oceanography from its representatives to the Third International Hydrographic Conference held at Monaco in April 1932.

The representatives of the Association were MM. Fichot, Witting and Proudman.

M. Fichot was also a national delegate for France and was elected President of the Conference. MM. Witting and Proudman were guests of the Conference with power only to advise; but they received such courtesy from all the officers and members of the Conference that they felt they were able to render very effective service. They attended all the plenary sessions except that concerned with the election of officers of the Bureau, and also all meetings of committees at which questions of oceanography were under discussion.

MM. Witting and Proudman regarded their duties to be as follows:

1. to place at the disposal of the Conference their knowledge of the science of oceanography and of organisations concerned with its development,

2. to utilise whatever means the Conference should allow them, to further the interests of the science of oceanography.

After consultation with the representatives of the Association, the delegates of France, Great Britain and Italy made five proposals relating to Tides and Mean Sea Level. These proposals were discussed at a special committee and then passed by the Conference in the following form.

1. That the Conference ask the International Hydrographic Bureau to request the Hydrographic offices to undertake the collection of information regarding tidal currents, including currents

in harbours, and to forward this collected information to the Bureau. On receipt of this information the Bureau should consider further steps in the direction of eventual publication and send to the States Members a proposal in that sense. (Corresponds to VI 4 a in the ultimate redaction of the resolutions).

2. That the International Hydrographic Bureau use its influence in getting the States Members to undertake systematic observation of currents by current-meters and the analysis of the resulting records. (VI 4 b).

3. That the Bureau consider the possibility of advising Governments, not possessing Departments organised for this purpose, both as to the desirability and means of undertaking the installation of tide-gauges, the analysis of the resulting records and the preparation of tide-tables. Such work, carried out for selected stations, is of importance both in the interests of Navigation and of Science. It is possible that such work might be financed by commercial corporations or by other institutions if they were brought to appreciate its utility. (VI 2 b).

4. It is desirable to inquire to what extent States Members of the Bureau might cause to be published yearly and monthly means of sea-level for a number of selected tide-gauge stations. It is considered that a total number of about sixty stations would suffice. (VI. 3).

(A note annexed to the Report of Proceedings indicates the method by which the Bureau might proceed to this inquiry by Cooperation with the International Union of Geodesy and Geophysics).

5. It is desirable to inquire in what way it may be possible to extend the world network of continuously working tide-gauge stations, so that along the coasts of the continents the distance between two stations should not exceed 1200 miles, and that some stations may be established on oceanic islands. It is considered that for this purpose about twenty new coastal stations and about ten new island stations would be sufficient. (VI 2 a).

Certain proposals regarding standards and conventions in physical oceanography had been made to the Conference, but the Conference agreed that these should be made to the Association.

Appendix 4.

Publication of the First Volume of the Manual for Scientific Observations on the Seas.

I beg to inform this Honorable Association that the first Volume of the Manual for scientific observations on the seas will soon be published.

I am sending for your information one of the chapters of the first volume of Professor De Martonne on the Morphology of the depth. From this specimen you will be able to form an exact idea of the publication and of its size.

Further chapters of the Manual are, as you know, the following: Numerical prospectuses, formulae and useful data for observations on the seas (Prof. Magrini).

Chronologies of Oceanographical Expeditions (Prof. De Buen).

Sounding operations (Instruments and Methods) Ing. Marthi.

I trust that the volume may be issued within the first half of next year.

G. Magrini

Stra, (Venice) 10 September 1933
to Association for Physical Oceanography

Appendix 5.

Publication of the Oceanographical Bibliography.

Not being able to take part in the Lisbon meeting, with reference to the Oceanographical Bibliography, I beg to inform you that the volumes referring to the years 1928—1929 and 1930 have been regularly published. Also the part dealing with physical oceanography and hydrography for the year 1931, has been duly issued.

I am pleased to present to the Presidency some copies of the above mentioned volumes and of the part referring to the work of 1931 on Physical Oceanography.

The publication of the works is proceeding regularly and now all the material for 1932 is so arranged that every year a volume will be published. I am even hoping to be able to gain time, so as to publish, during each year, the volume referring to the material of the preceding year.

That will, without any doubt, take place during the year 1936 when the book dealing with 1935 will be published.

I am glad to confirm that authors are sending in their publications, to be revised, in a most satisfactory way, so that it is to be hoped that the work will improve year by year.

We can't deny that certain defects, even certain faults still exist, but, as is the case in everything human, only little by little can perfection be attained.

G. Magrini

Stra, (Venice) 10 September 1933
to Association for Physical Oceanography

Appendix 6.

Mean Sea Level and its Changes.

Unification and Development of the World net of Mareographs.

A memorandum

drawn up by

ROLF WITTING.

I. The importance of data of M. S. L.

For the study of the tides and the tidal currents, of other movements of the sea surface and of currents of different origin, continual observations of sea level are the sole or a most valuable basis. For the solution of a complex of geophysical problems, data regarding sea level and its changes are of great importance:

1. Changes of currents of greater duration and of the stratification in the sea influence the height of sea level. Conclusions as to these changes can be drawn from differences of S. L. across or along an oceanic stream or current system, where direct measurements are almost impossible.

2. The water-masses of the north and south hemispheres are in mutual interchange. This may be felt *e. g.* in the variation of the latitudes.

3. The crustal movements of the north of Europe are resulting in an upheaval of the land, which in our days amounts to one metre per century in the middle part of Fennoscandia, and is felt as an upheaval or sinking of minor order at least at the German and Dutch coasts. It can be concluded that the coast in different parts of the world, *e. g.* in America, also is undergoing changes of this nature.

4. The amount of water in the oceans is changing, one cause being the state of glaciation at the poles. In this way *e. g.* the level of the oceans has risen some hundred metres in the last ten thousand years or so.

II. Proposals for international co-operation.

On various earlier occasions proposals for international co-operation in regard to greater or smaller areas have been made, and to some extent carried out.

The Tidal Committee of the Association dealt with this matter at the assembly in Paris (Section d'Océanographie, Bulletin n:o 1, pag. 18) in Rome (n:o 3, pag. 52) and in Madrid (n:o 5, pag. 30).

At the assembly of the Union in Prague 1927 Mr. W. D. LAMBERT proposed a joint committee of the Associations of Oceanography and Geodesy for the questions regarding mean sea level (Section d'Océanographie, Bulletin n:o 11, pag. 27).

At the conference of the International Hydrographic Bureau in Monaco 1932, in which delegates of the Association took part as invited guests, recommendations in this matter were passed (see the report of the delegates).

At this meeting it is proposed to create a joint committee for the study of the problems of the earth's crust, such Committee to consist of members of the Associations of Geodesy, Seismology, Vulcanology and physical Oceanography.

As this proposal relates only to a part of the question and as the work is very great, it seems advisable that the Association should take under consideration the appointment of a permanent committee for mean sea level, perhaps as a joint committee of this Association and the Association of Geodesy. Some members of this M. S. L. committee could be members of the Earth crust committee and function as a link between them. In the same way co-operation with the Tidal Committee would be of use.

III. The mareographical stations.

The mareographical stations should be classed as *permanent* stations and *temporary* stations, principally for tidal work.

Of the permanent stations, certain selected ones could be regarded as *capital* stations whose working in the future in no way should be closed and whose results could be rapidly published.

Permanent stations are now working along the coast of Eurasia, except at the northern coast from the Kola peninsula eastwards, and along the coast of U. S. A., though there are none on the northern coast of America nor on Greenland. In the southern part of South-America there are some, in the northern part and in Central-America there are none, while others are to be found along the French coast of Africa, in Egypt and at the Cape and some in Australia. But great gaps nevertheless exist in the net.

The filling of these gaps would be of great value. Data from stations at a distance not exceding 1,200 nautical miles would give a good first conception of the phenomena. About 20 new capital coastal stations would be enough to fill these gaps and about 10 new capital stations on oceanic islands would form a good link between the coasts.

IV. The reduction and publication.

Some conventions regarding the reduction of the registrations and the publication of the results of the capital stations should be agreed upon.

1. The mareographs should be of a construction which would guarantee unbroken registrations.

2. The zeros of the mareographs should be under sufficient control through levelling of high order to bench marks in rocks or such of first order.

The reduction should give:

3. For some years hourly readings, necessary for the deduction of the tidal constants;

4. Later on, if continual hourly readings are not necessary, readings for 0^h, 4^h, 8^h, 12^h, 16^h and 20^h G. M. T.

5. Monthly means, calculated for calendar months from the readings given above. — The monthly means should be corrected for the tidal deviation of the first and last unfinished tidal period of the month, and

6. Yearly means calculated from the monthly means.

The reductions sub 5. and 6. would correspond with the reduction of the corresponding meteorological means.

Already existing permanent stations which will be chosen as capital stations and the registrations of which are not wholly worked out may be treated as above.

The publication of the results of all capital stations in the same publication will probably remain only a desideratum. As a matter of course, the different central boards should publish their results, at least the monthly and yearly means. In a common publication the different national publications should be enumerated, and monthly and yearly means not printed elsewhere should be published therein.

Appendix 7.

Étude systématique de Balance de l'Acide Carbonique entre la Mer et l'Atmosphère

proposé par

KURT BUCH et ROLF WITTING.

La connaissance de la distribution de l'acide carbonique dans la mer est d'importance pour la solution des questions océanographiques diverses, pour l'étude biochimique des conditions de la vie dans la mer, pour l'explication de la distribution de l'acide carbonique dans l'atmosphère, pour la discussion des changements du climat, pour l'interprétation des conditions de naissance des sédiments calcaires etc.

Un fait connu depuis longtemps déjà est, que l'acide carbonique de la mer et celui de l'atmosphère se trouvent dans une telle correspondance mutuelle, que la mer est à même de balancer l'acide carbonique de l'air en l'absorbant ou l'exhalant, dépendant du cas que la tension de l'acide carbonique de la mer soit plus faible ou plus forte que celle de l'air. Cette régularisation est mutuelle et automatique. L'équilibre entre les différents constituents de l'acide carbonique dans l'eau de mer et indirectement aussi la balance avec l'atmosphère sont gouvernés par la loi d'action des masses. Une détérmination quantitative du système de l'acide carbonique de la mer ainsi que de cette balance a été faite sur l'ordre du Conseil international pour l'exploration de la mer par une commission de travail consistant des MM Kurt Buch, H. W. Harvey, H. Wattenberg et Mlle S. Gripenberg, dont le rapport a paru dans les actes du conseil. L'examen, qui comprend une constatation de l'équilibre des différents constituants de l'acide car-

bonique et des fracteurs, dont celui-ci dépend, a donné comme résultat la possibilité de calculer, par un nombre restreint de données analytiques, tout le système d'acide carbonique ainsi que la tension.

Cette question de balance de l'acide carbonique ne peut être solue qu'à l'aide d'observations comprenant toutes les mers et toutes les saisons de l'année et, vu qu'elle est d'un intérêt exceptionel, il serait sujet de la prévoir dans les programmes comme un travail océanographique obligatoire, autant plus que cela pourrait se faire avec des moyens très modestes. Les observations nécessaires et la prise des épreuves pourront se faire de la manière la plus naturelle en combinaison avec le travail océanographique général. Outre les détérminations usuelles de la température et de la salinité viendront la détérmination de pH et de l'alcalinité titrinétrique (l'alcalinité totale), naturellement des eaux de la surface seulement.

Pour que les détérminations soient en conformité aux résultats des travaux de la dite commission et qu'elles puissent servir aux calcules du système, il faut observer pour l'exécution:

La détérmination de pH se fera de la manière colorimétrique en se servant des solutions stabilisateurs de borax et d'acide borique. (à voir Palitzsch: Über die Anwendung von Borax und Borsäurelösungen bei der colorimetrischen Messung der Wasserstoffionenkonzentration des Meerwassers. Biochem. Z. *70*, 333, 1915, Palitzsch, S: Sur l'emploi de solutions de borax et d'acide borique dans la détérmination colorimétrique de la concentration en ions hydrogène de l'eau de mer. Compt. rend. Lab. Carlsberg. *11*, 199, 1916, Clark W. Mansfield: Determinations of Hydrogen-Ions. 3rd Ed. Baltimore 1928, p. 213.)

Comme indicateur servira le rouge de crésol (à voir Ramage et Miller Clark p, 182) et pour l'erreur de température (à voir Buch: On the Determination of pH in Seawater at Different Temperatures. Journal du conseil pour l'exploration de la mer. Vol. IV, N:o 3, 1929.) Pour les détérminations la plus grande vitesse possible est d'urgence pour que la température ne puisse changer sensiblement, et sont à annoter outre la température de l'eau encore la température des solutions stabilisateurs; en outre sont à observer les circonstances annotées dans le travail de K. Buch.

L'alcalinité totale est détérminée selon les prescriptions de M. H. Wattenberg. (Über die Bestimmung der Alkalinität des

Meerwassers. Ann. d. Hydrographie und Maritimen Meteorologie, Jahrg. 1930, Heft VIII. p. 280).

Comme l'alcalinité pour des vastes zones maritimes est proportionelle à la salinité, les épreuves prises pourront être bien moins nombreuses que pour les détérminations de pH.

Il n'est pas necéssaire de faire la detérmination de l'alcalinité totale immédiatement après la prise des épreuves, pourvu que celles-ci sont gardées dans des bouteilles bien fermées de vers resistant, ne rendant pas d'alcali.

Cette communication est faite pour attacher l'attention des océanographes sur cette question.

Appendix 8.

On Determination of Mixing in the Sea.

By

ROLF WITTING.

I. Experiments.

1. In order to obtain some light on the question of mixing, the writer, after preparatory experiments in 1929, arranged for a few experimental measurements to be carried out in the Gulf of Finland in August 1932. An account of these proceedings is given below.

While the research-ship »Nautilus» lay at anchor, a hose-pipe, made of heavy canvas, strengthened by brass rings, and borne by an outrigger, was rigged up aft. This hose was L-shaped, the two legs being each two metres in length, with a diameter of 30 cm. The horizontal leg was immersed in the sea up to its centre axis, the mouth of the hose being situated about 3 ½ m. distant from the sternpost of the ship. Seawater was conveyed to this hose by means of the donkey-pump of the ship, and to this water a solution of Powderfuchsin AB in ordinary fresh water — generally in the proportion 1 : 400, — was added. This solution was prepared in an iron cylinder on the upper deck, and was then conveyed through a pipe to a regulating vessel, in which the surface of the colour solution was maintained at a certain fixed height by regulation of the supply. A rubber pipe with copperwire strengthening, leading from the bottom of the aforesaid vessel, and with an opening set for a certain fixed outflow, carried the solution to a bucket placed within the vertical leg of the hose. In this bucket, to which the seawater pumped up by the donkey-engine was conveyed direct, the two kinds of water were thoroughly mixed, and the mix-

ture then flowed over the sides of the bucket, and down into the large hose-pipe. Colour solution was carried to the bucket at the rate 0.2 liter per second and seawater at 3.4 liter per second. The calculated concentration of the water flowing from the mouth of the hose was thus 1 : 6760, which also agreed with the direct determinations within the limits of exactitude (1 : 6,000 to 1 : 7,000).

2. The determination of the colouring of the seawater was carried out colorimetrically. Normal colour solutions of the strength 1 : 5,000, 1 : 10,000, 1 : 20,000, 1 : 40,000 — to 1 : 10,240,000 (thus $1 : 5{,}000.2^{n-1}$, $n = 1, 2, 3 \ldots\ldots 12$) ready prepared in the laboratory were used as normals. Test-tubes of uniform size, filled with these colour solutions, were arranged in holes around the circumference of a circular wooden frame with empty-holes between for the samples. The colour of the samples was now denoted by the n-figures of the corresponding normals. The position of the points at which the samples were taken was duly determined by compass and sextant. Temperature and salinity and current were also determined. Charts on the scale 1 : 250 were drawn of these experiments.

The preparatory experiments showed that in our greenish-yellow seawater the colour degree 12 of the scale corresponds fairly to the limit of possible observation. When the layer is thick, a weak, reddish glimmering, which cannot be determined in the test-tubes, or is hesitatingly given as »barely degree 12», appears above a white vessel immersed to a depth of about 1 metre. In conformity herewith, the determinations of the breadth and depth of the coloured body refer to an observed degree 12.

3. If we begin with the expression

$$- s\frac{\partial u}{\partial x} + a^2\frac{\partial^2 u}{\partial x^2} + b^2\frac{\partial^2 u}{\partial y^2} + c^2\frac{\partial^2 u}{\partial z^2} = 0 \qquad (1)$$

we derive [1])

$$a = \frac{R}{2}\sqrt{\frac{sK}{xu\,(x,0,0)}}. \qquad (2)$$

[1]) See: *Rolf Witting*, Zur Bestimmung der Mischung im Meere, Societas Scientiarum Fennica. Comment. Phys-Math. VII. 2. Helsingfors 1933.

$$b = \frac{y}{2}\sqrt{\frac{Ms}{x \log \frac{u\,(x,0,0)}{u\,(x,y,0)}}} \tag{3}$$

and

$$c = \frac{z}{2}\sqrt{\frac{Ms}{x \log \frac{u\,(x,0,0)}{u\,(x,0,z)}}}. \tag{4}$$

in which a, b, and c are exchange coefficients, K the concentration at the mouth, R the radius of the mouth, x, y and z are coordinates, x on the surface in the direction of the current, y straight across the current and z towards the depth, $u\ (x, y, z)$ the concentration at one point, s the velocity of the current and M the modulus for Briggs' logarithms.

4. The following example may be given, where $x =$ the distance in metres from the mouth, in the direction of the current, $2y =$ breadth in metres between the concentration degrees 12 on the surface of the coloured strip, $z =$ depth in metres of the concentration degree 12 on the central line; $F = u\ (0, 0,0)/u\ (x, 0,0)$; $G = u\ (x, 0,0)/u$ (degree 12); a, a_{corr}, b and c the coefficients of exchange.

Table 1. Experiment 5. 1932 VIII 11. $12^h\ 14^m - 13^h\ 20^m$.

x	$2y$	z	F	G	a	a_{corr}	b	c
15	4	1.35	32	32	3.2	3.5	4.0	2.7
120	27	1.2	384	3	3.9	4.3	17.0	1.7
170	34	—	512	2 ?	3.8	4.2	23	—
230	—	—	768	—	4.0	4.4	—	—

Table 2. Experiment 6. 1932 VIII 11. $14^h\ 12^m - 15^h\ 13^m$.

x	$2y$	z	F	G	a	a_{corr}	b	c
18	—	—	48	32	3.7	3.9	—	—
35	—	2	96	16	3.7	3.9	—	3.1
90	37	< 1.5	192	8	3.3	3.5	20	< 1.6
130	35	< 1.5	316	4.6	3.5	3.8	19	< 1.5
210	55	< 1.5	512	3	3.5	3.8	27	< 1.5

II. The Coefficients of Exchange.

5. A glance at the coefficients of exchange obtained, shows that the a-values lie within fairly narrow limits, the b-values increase with the distance from the mouth, while the c-values on the other hand decline, although more slowly. The following table shows the means of the a-, b- and c-values interpolated from experiments 5—11, arranged according to the respective length of the mixing way.

Table 3.

Mix. way.	a	a_{corr}	b	c
15 m	3.4	3.2	4.9	2.7
30 m	2.9	3.2	5.4	2.5
60 m	3.0	3.4	10	2.2
90 m	3.0	3.4	15	1.9
120 m	3.1	3.5	19	1.8
150 m	3.3	3.7	20	1.7
200 m	3.2	3.7	(25)	1.6

The increase in b-values which appears in proportion to the length of the mixing way travelled or the length of the mixing time, seems to indicate a quite irregular relation. However, still another circumstance of a highly important nature cooperates here. When the coloured area of water was crossed farther from the ship, it was found that the concentration did not correspond to the symmetrical distribution function derivable from equation (1). Farther away from the ship were several maxima of concentration, separated one from the other by strips of less strongly coloured, often even clear, water. In accordance herewith, »current bodies» thrown out at the same time and place showed irregular movements. This circumstance must obviously so influence matters that the measured breadth of the coloured body of water proves to be too great, that consequently the b-values calculated according to equation (3) are also too great, and that therefore these values do not comprise solely the exchange pure and simple, but also in addition another aspect of the water movement. This distribution

in tongues of the coloured jet of water had a slighter influence on the a-values, as is also apparent from tables 1 and 2. None the less, there was always a maximum value of the concentration present in the crosscut. This branch-like distribution must, however, influence also the a-values in such a manner that they are the greater, the longer the mixing ways or the times of mixing, as is also apparent from the tables. In consequence hereof the a-values obtained for a shorter mixing way are to be regarded as the more correct.

6. The question now arises how far the exchange coefficients are influenced by currents and winds, and also by the stratification of the sea.

In view of what has been pointed out above, the a- and more especially the b- and c-values cannot, as far as longer mixing ways are concerned, be regarded as pure exchange coefficients. We therefore keep to the values obtained for a shorter way and choose a round 30 metres. We arrange these values for the coefficients of exchange according to the strength of the wind and the velocity of the current and after calculation of means, arrive at the tables 4 and 5.

Table 4.

Wind m/sec	a	a_{corr}	b	c	Current cm/sec	Experiment
2.0	2.2	3.0	4.2	2.2	6.7	9,8
2.7	3.3	3.1	6.2	3.1	14.0	6,10,11
4.2	2.6	3.4	5.3	2.2	6.0	5,7

Table 5.

Current cm/sec	a	a_{corr}	b	c	Wind m/sec	Experiment
3.4	1.9	3.4	4.8	1.6	3.0	7,9
9.4	2.8	3.0	4.7	2.9	3.0	5,6,8,11
23.2	5.1	3.3	9.6	3+	2.7	10

Taking first of all the a-values, these must be regarded as but slightly disturbed. The a_{corr} are to be regarded as equally great within the limits of exactitude. Even if the mouth correc-

tion, more especially in the case of higher velocity of current, should not be quite exact, it must nevertheless be assumed that this correction must run in the direction from a and $a_{corr.}$ Neither do the unaltered a-values deviate too much one from the other, the only exception being the value for 23.2 cm/sec velocity of current, which, however, is based on one experiment only, and should in any case be lowered to some extent. Were one to venture to draw any conclusion from the above tables, it would be that the magnitude of the exchange increases rather with the velocity of the wind than with the velocity of the current. The influence of the high values obtained in experiment 10 is seen also in the coefficients b and c. One is inclined also in this case to assume a slight increase with wind and current.

The water of the uppermost couple of meters was homogeneous in five of the experiments, increasing in density in two. No appreciable difference can be found between these two cases.

III. Summary.

7. The experiments yielded *an exchange coefficient* at the surface of the size 3—3.5 cm $sec^{-1/2}$, which, if we compare it with the often used coefficient of friction, corresponds to a value for $\frac{\mu}{\rho}$ of about 10 cm^2 sec^{-1}.

An increase with the velocity of wind within the interval 2.0 to 4.2 m/sec is indicated, but is not large. The possible increase with the velocity of current appears to be small.

The mixing in the *horizontal* direction is not only determined by a diffusoid exchange effect; there appears here a dispersion of the flowing water, which is to be interpreted as a gradually occurring branching off of a body of water enclosed at a given place, *i. e.* as a kind of whirling of a higher order.

As regards the exchange in the *vertical* direction, this declines with the depth within the upper couple of metres. This is, however, not to be ascribed solely to the current stratification present in some experiments, but to the fact that the movability of the water diminishes with the depth.

Appendix 9.

Thalassological work in Finland.

By

ROLF WITTING and GUNNAR GRANQVIST.

Thalassological work is pursued in Finland at a State institution, the Thalassological Institute (Finnish: Merentutkimuslaitos, Swedish: Havsforskningsinstitutet) at Helsingfors, the capital of Finland. Its aim is the scientific study of the seas around Finland: their general conditions, the physical and chemical properties of the sea water, the variations of the water level, of the currents and of the ice, as well as other questions relating to the above; moreover the Institute represents Finland outwardly in international oceanographical work. It was founded in 1918.

Already, during 20 years, from 1898 onwards, methodical thalassological work had been carried out in Finland under the supervision of the Finnish Society of Sciences. The work, organized by the said Society, was executed to begin with at the already existing Meteorological Institution, as well as by the Hydrographical Biological Commission, specially appointed for the purpose. Especially through the activity of the latter, a new institution, The Hydrographical Biological Investigations of the Sea, working under the supervision of the Society, gradually came into being, and all research work relating to the subject was transferred to the same.

The Director of the »Investigations» having received necessary assistance in the work and the Directorship having been introduced on the Civil list in 1917, the »Investigations» in fact constituted the ready pattern on which the Thalassological Institute was formed.

The earliest attempts at systematic investigations in the sphere of the present activities of the Thalassological Institute date, however, much earlier than 1898. Already in the eighteen forties the Finnish Society of Sciences started water stage observations and in the fifties a network of tide pole stations, which still functions,

was created in collaboration with the Board of Navigation. Notes concerning the ice conditions, chiefly of the formation and breaking up of the ice, had also been made of old at some places, in lighthouse and pilot journals and from the forties there are sporadic ice observations, executed at the instigation of the Society. However, only in the nineties did the question as to ice conditions in the open sea become important, owing to the newly awakened interest in winter navigation.

The present Institute has special departments, for both of the above-mentioned lines of investigation, that is the water stage and the ice, which, with respect to the time when the organization of the work was begun, were called the 1:st and the 2:nd department, the work of the latter naturally also comprising the study of the heat conditions in the sea as well as that of the stratification. The chemical conditions in the sea are studied at a 3:rd department, the chemical laboratory, where moreover all the chemical analyses necessary for the general work are carried out. At present, the question of a somewhat different distribution of the work between the three departments is being discussed in order to equalize the labour, certain parts of the routine work, especially the ice surveying for the benefit of navigation, having become in the last few years more extensive than could be earlier expected.

At the head of the Institute there is a d i r e c t o r and at the head of each of the three departments a head scientist, called »t h a l a s s o l o g i s t»; there are furthermore f o u r s c i e n t i f i c a s s i s t a n t s, t h r e e o f f i c e c l e r k s for typewriting and calculation work, a r a d i o t e l e g r a p h i s t and an office and laboratory k e e p e r. Extra forces have been used occasionally.

The research vessel, s/s Nautilus, is put at the disposal of the Institute by the Board of Navigation for part of the summer for research and inspection cruises. The early cooperation with the Board of Navigation for the solution of practical problems has been maintained and developed. Thus, the staff of observers and reporters which, according to given instructions and under the control of the Institute, make the regular primary observations serve under the Board of Navigation on lighthouses, light vessels, on ice-breakers and at pilot stations. As the observations for the Institute each time only claim a short moment's work, but on the other hand have to be done at regular hours, sometimes many times daily, and besides this require that the observer be accustomed

to the sea, it has proved advantageous that such a staff of co-workers was available. All observations are paid for, even if the payment on account of the nature of the work is comparatively small. The Institute corresponds with observers and reporters by post, telephone, telegraph and by radio; for the latter correspondence the Institute has its own wireless station since 1931.

As mentioned above, the chief task of the first department is to conduct and compute the water stage observations; at present there are 17 water stage registering stations, of which 15 in the Baltic, one in the Arctic Sea at Petsamo and one in Lake Ladoga; their position is marked by small squares on Fig. 1. (on which Petsamo and Lake Ladoga do not appear).

There are furthermore 21 tide pole stations, of which 20 in the Baltic and one in Lake Ladoga. The number of tide pole stations has been reduced in later years owing to the increasing number of registering stations; all stations are inspected and relevelled every summer.

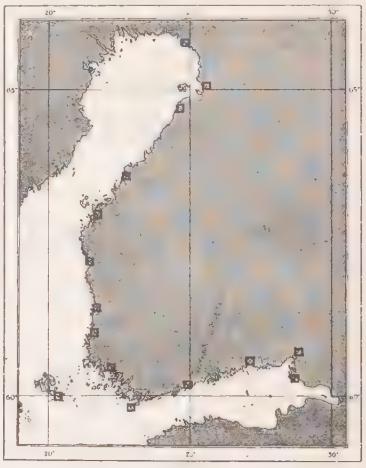


Fig. 1. Water stage registering stations along the coast of the Baltic.

All the registering gauges except one, which is of an older model, are of a type worked out at the Institute, which records the water stage fluctuations in natural scale on a roll of paper. A control of the distance between the water level and a fixed mark is taken weekly. The records are read at the Institute with the aid of a specially built machine, which electrically displaces the paper roll by ranges of one hour at a time; a needle is then adjusted to the exact point of the curve, whereupon the water stage figure is automatically written down on a special form.

The second department has to direct and control the ice surveying and to compute the thalassological observations, which are sent in by the field stations.

Regular ice observations are made at over a hundred stations along the coast of the Baltic and in the north part of Lake Ladoga

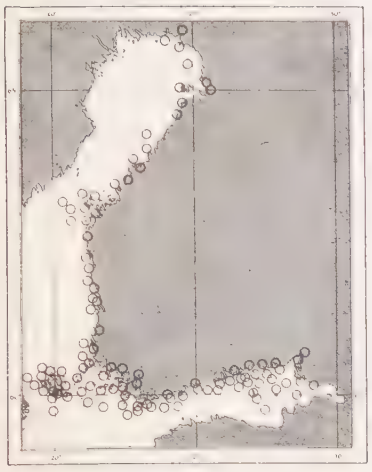


Fig. 2. Ice surveying stations along the coast of the Baltic.

(see Fig. 2) The observations are noted day by day in journals, which are sent to the Institute every Friday, together with a large scale map recording the ice situation on the day of despatch. On the basis of these maps, as well as on all other available material, a detailed map is worked out at the Institute every Friday. These maps, reduced to the scale 1 : 5 and somewhat more schematical, are published in the yearly ice reports of the Institute and constitute the basis on which the scientific treatment of the ice question is founded.

These ice observations, however, are not handed in quickly enough to be able to serve for the daily ice reports for the benefit of navigation. The primary data for these reports are sent in daily in clear language by wireless from ice breakers at work and ciphered by wire or wireless from about 25 ice reporters, partly belonging to the above mentioned observers, partly to the harbour authorities of the coast towns. If necessary, and at least once a week at appointed hours, the Institute furthermore discusses the ice situation over the telephone with about 30 ice observers. On all these data are based the ice reports of the Institute, which are given three times daily by radio, since 1932 also on Sundays, in Finnish, Swedish, English and German and twice daily by wireless in ciphered form. Reports are also sent by post to interested parties in clear language and are published by the press. The last mentioned kind also contain the ice reports sent in daily by the other Baltic States. Once a week, a general map is added to the daily report.

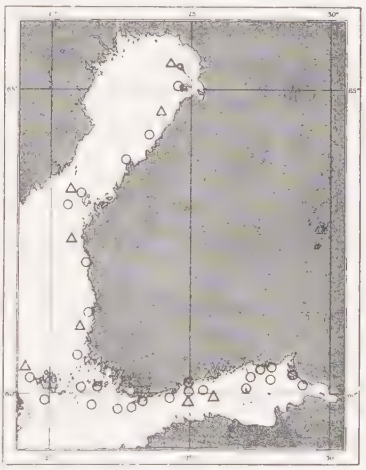


Fig. 3. Thalassological stations in the Baltic.

The thalassological routine observations are made at 26 coast stations (on Fig. 3 marked by circles) and 8 light vessels (marked by triangles) in the Baltic and on o n e light vessel in Lake Ladoga. At the coast stations the surface temperature near the shore is taken daily at 14 o'clock (at some stations at 7, 14 and 21 o'clock), besides which a water sample is taken six times a month for determination of the salinity. Three times a month, at a fixed place in the sea outside the station, deep-sea observations are made, temperatures and water samples being then taken from different depths. Direction and intensity of the wind as well as motion of the sea are furthermore noted in the journal three times daily. On the light vessels daily current measurements at three different depths are added to the observations. All stations are provided with surface and reversing thermometers, controlled at the laboratory of the Institute, as well as with a complete set of reserves. The instruments are inspected every summer and exchanged, if necessary. At the same time, the supply of water sample bottles is replenished.

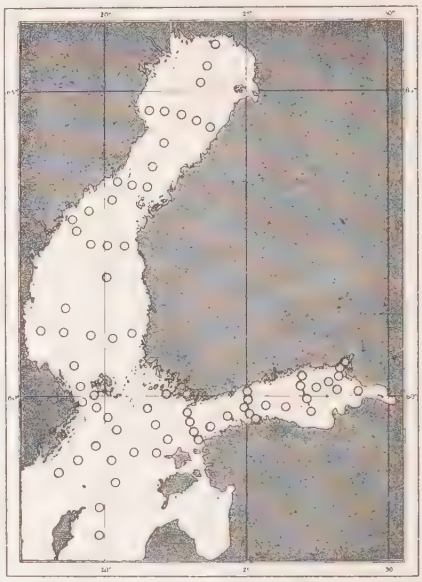


Fig. 4. Open sea stations.

The annual cruises, arranged by the Institute and at present taking place in the month of July, are not assigned to any special department; the preparations are principally made by the 2:nd department, in collaboration with the 3:rd, or chemical department. During these cruises about 65 open sea stations are regularly taken (see Fig 4), the majority identical with the stations established in the beginning of the international work for the exploration of the sea. Temperatures are determined at fixed depths and water samples taken for determination of salinity, oxygen-content and p_H. Samples for determination of ammonia, carbon dioxide, phosphates and nitrate have also been taken. Customary meteorological observations are made at each station and, wind

and light permitting, the transparence of the water determined with and without colour filters. Surface samples are taken every hour between the stations for determination of temperature and salinity. In earlier years a biologist generally took part in the cruise; the biological work is now arranged in a different way.

For the study of special problems extra cruises are made when desirable. As such may be mentioned the echo soundings in certain waters, made during the years 1927—30 (on the suggestion of the Institute the echo sounding work has now been transferred to other institutions). A number of current measuring cruises have been made to different parts of the Baltic during the last few years, whereby an electrically, on board the ship registering current-meter has been used, also cruises for the study of the phenomenon of mixing, amongst others making use of a method of colouring the sea water; it may be noted that the latter phenomenon has been also studied in the laboratory. In this connection, the participation of the Institute in the current measurements in the Cattegat in August 1931 should be also mentioned.

The activity of the 3rd department has been already partly referred to. The routine work consists in the analysis of all water samples sent in. Special objects of study have been the carbonic acid equilibrium, metabolism in the sea water, the nitrogen question, all of which have caused laboratory work in the nature of routine work as well as of a methodical kind; may it be specially mentioned that investigations were carried out in the chemical laboratory in 1931, by a committee appointed by the International Council, with the special object of studying the carbonic acid question. The department has also given attention to the question of the chemical composition of sea water.

Parallel with the collection, the Institute carries on the primary treatment of the material and, if possible, publishes the observations within a year of their collection. The observations are published yearly, each kind separately, in the publication series of the Institute of which until now about 90 numbers have been issued. In connection herewith the primary material has been used for the scientific study of certain problems of general importance. As a result of these activities a number of investigations have been published, partly in the Series of the Institute, but mostly in other scientific journals, among which investigations are such that deal with the general properties of the sea, the stage of the water, the

upheaval of the land, the inclination of the sea level, stratification, economy of heat, currents, ice conditions, the metabolism in the sea, and with methods and apparatuses used for such investigations.

Besides in the regular ice reports and in the Publications, the outward activity of the Institute also manifests itself in numerous verdicts to public institutions, as well as to private persons. These refer to the stage of the water, currents, winds, motion of the sea, the chemical and physical properties of the sea water and, above all, to the ice conditions. Such verdicts have been given for different scientific purposes, for harbour and bridge buildings, submarine water conduits, drawing off and purifying of sewage, industrial use of sea water, organization of shipping relations, possible damage on freights, proceedings in maritime law suits regarding averages, salvage, application of ice clauses, etc.